

Transmittal Letter to the United States  
Designated/Elected Office (DO/EO/US)

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FORM PTO-1390

Docket No. : **HM-361PCT**  
U.S. Application No. :  
International Application No. : **PCT/EP99/02465**  
International Filing Date : **APRIL 13, 1999**  
Priority Date Claimed : **APRIL 15, 1998**  
Title of Invention : **ROLL STAND WITH AXIALLY DISPLACEABLE ROLLS**  
Applicant(s) for (DO/EO/US) : **Günter Knepe, Heinz-Adolf Müller, Konrad Roeing  
and Karl-Friedrich Müller**

**532 Rec'd PCT/PTC 13 OCT 2000**  
**09/673327**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures 35 U.S.C. 371 (f) at any time rather than delay examination until the expiration of the applicable time limit set forth in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed [35 U.S.C. 371(c)(2)].
  - a) ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b) ☐ has been transmitted by the international Bureau.
  - c) ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English [35 U.S.C. 371(c)(2)]
7. ☐ Amendments to the claims of the International Application under PCT Article 19 [35 U.S.C. 371(c)(3)]
  - a) ☐ are transmitted herewith (required only if not transmitted by the International Bureau)
  - b) ☐ have been transmitted by the International Bureau.
  - c) ☐ have not been made; however, the time limit for making such amendments has **NOT** expired.
  - d) ☐ have not been made and will not be made
8. ☐ A translation of the amendments to the claims under PCT Article 19 [35 U.S.C. 371(c)(3)].
9. ☒ An oath or declaration of the inventor(s) [35 U.S.C. 371(c)(4)]. **UNSIGNED**
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 [35 U.S.C. 371(c)(5)]

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 198.
12. ☐ An Assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.  
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification
15. ☐ A change of power of attorney and/or address letter
16. ☒ (other items or information) **One sheet of drawing, PTO-1449 w/3 references and International Search Report**

EXPRESS MAIL No. EL 599 503 132 US Deposited: October 13, 2000

I hereby certify that this correspondence is being deposited with the United States Postal Service Express mail under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, DC 20231

  
Friedrich Kueffner

October 13, 2000  
Date

09/673327

430 Rec'd PCT/PTO 13 OCT 2000

U.S. Application No (if known, see 37 C.F.R. 1.50):  
 International Application No. : PCT/EP99/02465

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 Docket No: HM-361PCT

17. ☒ The following fees are submitted:

**BASIC NATIONAL FEE [37 CFR 1.492(a)(i)-(5)]:**

- ☒ Search Report has been prepared by the EPO or JPO. .... \$ 840.00
- ☐ International preliminary examination fee paid to USPTO [37 CFR 1.482]:... \$ 670.00
- ☐ No International preliminary examination fee paid to USPTO [37 CFR 1.482]  
 but International search fee paid to USPTO [37CFR 1.445(a)(2)]:..... \$ 690.00
- ☐ Neither International preliminary examination fee [37 CFR 1.482] nor  
 International search fee [37 CFR 1.445(a)(2)] paid to USPTO:..... \$ 970.00
- ☐ International preliminary examination fee paid to USPTO [37 CFR 1.482]  
 and all claims satisfied provisions of PCT Article 33 (2) to (4)..... \$ 96.00

ENTER APPROPRIATE BASIC FEE AMOUNT: \$ 840.00

Surcharge of \$ 130.00 for furnishing the oath or declaration later than 20 30 months  
 from the earliest claimed priority date [37 CFR 1.492(e)]

\$ 840.00

Claims	filed	Extra	Rate
Total Claims	8	-20=	x \$ 18.=
Indep. Claims	2	- 3=	x \$ 78.=
Multiple Dependent Claims (if applicable) + \$ 260.=			

TOTAL OF ABOVE CALCULATIONS: \$ 840.00

Reduction by  $\frac{1}{2}$  for filing by small entity, if applicable. Verified Small Entity  
 Statement must be filed also. [Note 37 CFR 1.9.1.27, 1.28]

(divided by 2)

SUBTOTAL: \$ 840.00

Processing fee of \$ 130.00 for furnishing the English translation later than 20 30 months  
 from the earliest claimed priority date [37 CFR 1.492(f)]

\$

TOTAL NATIONAL FEE: \$ 840.00

Fee for recording the enclosed assignment [37 CFR 1.21(h)] the assignment must be  
 accompanied by an appropriate cover sheet [37 CFR 3.28,3.31]. \$ 40.00 per property

\$

TOTAL FEES ENCLOSED: \$ 840.00

AMOUNT TO BE REFUNDED: Refunded \$

AMOUNT TO BE CHARGED: Charged \$

a) ☒ A check in the amount of \$ 840.00 to cover the above fees is enclosed.

b) ☐ Please charge my Deposit Account No. 11-1835 in the amount of \$ to cover the above fees  
 A duplicate copy of this sheet is enclosed.

c) ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any  
 overpayment to Deposit Account No. 11-1835. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 36 CFR 1.494 or 1.495 has not been met, a petition to revive [37 CFR 1 137(a) or (b)] must  
 be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Friedrich Kueffner  
 342 Madison Avenue  
 Suite 1921  
 New York, NY 10173

Friedrich Kueffner  
 Name

signature

29,482  
 Reg. No.

October 13, 2000  
 Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

HM-361PCT

Applicant(s) : Günter Knepe, et al  
Serial No. : NOT YET KNOWN (PCT/EP99/02465)  
Int. Filed : APRIL 13, 1999  
For : ROLL STAND WITH AXIALLY DISPLACEABLE ROLLS

Assistant Commissioner for Patents  
Washington, D.C. 20231

**PRELIMINARY AMENDMENT**

S I R:

In advance of the first office action, please amend the claims  
as follows:

**IN THE CLAIMS**

Claim 1, line 6, change "characterized in that" to --wherein--.

Claim 2, line 1, change "characterized in that" to --wherein--.

Claim 3, line 1, change "characterized in that" to --wherein--.

Claim 4, line 1, change "claims 2 or 3, characterized in"  
to --claim 2, wherein--;  
Line 2, delete "that".

Claim 5, line 1, change "one or more of claims 1 to 4,"  
to --claim 1,--;  
line 2, change "characterized in that" to --wherein--.

Claim 6, line 1, change "characterized in that" to --wherein--.

Claim 7, line 1, change "one or more of claims 1 to 6,"  
to --claim 1,--;  
line 2, change "characterized in that" to --wherein--.

Claim 8, line 1, change "one or more of claims 1 to 7,"  
to --claim 1,--;  
line 2, change "characterized in that" to --wherein--.

#### REMARKS

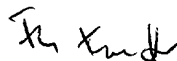
Claims 1 - 8 are in the application.

As a result of the foregoing amendment, the claims have been amended to remove improper multiple dependencies.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 11-1835.

Respectfully submitted,

FK:ml  
October 13, 2000  
342 Madison Avenue  
New York, NY 10173  
(212) 986-3114



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Friedrich Kueffner  
Reg. No. 29,482

EXPRESS MAIL No.: **EL 599 503 132 US** Deposited: **October 13, 2000**

I hereby certify that this correspondence is being deposited with the United States Postal Service Express mail under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, DC 20231.



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Friedrich Kueffner

1/ppts

09/6/3327

430 Rec'd PCT/PTO 13 OCT 2000

Translation of International Application WO 99/52657

Roll Stand with axially displaceable rolls

The invention relates to a roll stand for hot-rolling or cold-rolling of rolled strips of different materials, including work rolls, back-up rolls and, optionally, intermediate rolls, wherein the rolls of at least one pair of rolls are axially displaceable toward both sides and have contours suitable for compensating rolling defects.

EP-B 0 091 540 describes a roll stand of the above type constructed as a four-high or six-high roll stand. In the four-high roll stand, the work rolls as well as the back-up rolls are axially displaceable relative to each other, wherein the displacement of the back-up rolls takes place either independently of or together with that of the work rolls. The six-high roll stand has work rolls which are supported by intermediate rolls which are supported by back-up rolls, wherein the work rolls and/or the back-up rolls and/or the intermediate rolls are axially displaceable relative to each other and the rolls of at least two pairs of rolls are provided with curved contours extending over the entire length of the roll bodies, wherein each curved contour is composed of a convex portion and a concave portion, and wherein the roll body contours of rolls which support each other or interact with each other support each other exclusively in a certain relative axial position of these rolls. The rolls are supported in sliding bearings which are mounted in chocks. The chocks are provided with sliding surfaces which slide on each other or on crossheads of the roll stand and are axially displaceable by means of push rods. The structural requirements for this construction are substantial.

The invention is based on the object of simplifying the axial displacement of the rolls of a roll stand as compared to the

solution with displaceable chocks.

The object is met by providing each displaceable roll with at least one hydrodynamic oil film bearing, wherein a hydraulic unit producing the axial displacement is integrated in the oil film bearing. Since, contrary to the sliding surfaces of the chocks, the rolls float on their hydrodynamic oil films in the hydrodynamic oil film bearings, the friction is slight even in axial direction. This makes it possible to axially position the rolls without problems and without transition and with the application of little force. The integrated hydraulic unit has a small structural size as compared to the previously conventional push rods and is a component of the roll bearing.

Because of the low friction of the bearing, the axial displacement can be carried out under load. Because the hydraulic unit requires little space, it can be used in all types of rolls (work rolls, back-up rolls and intermediate rolls).

The back-up roll is ground for hot rolling with a ground contour of the  $n$ -th degree. In the frontmost stands of a hot rolling train, the back-up roll is displaced in order to compensate the thermal crown of the work rolls, particularly during endless rolling. Presetting is carried out with the CVC work rolls.

In the rearmost stands, the displacement of the work rolls serves for evening out wear and thermal crown. The adjustment of the roll gap profile takes place by bending the rolls. The displacement of the back-up rolls in the rearmost stands increases the adjustment range for the preadjustment of the roll gap profile and is particularly useful in narrow, soft strips as well as in hard, wide strips.

The back-up roll is ground for cold rolling with a CVC contour for compensating  $x_2$ -defects, in order to compensate planarity defects. The work rolls or intermediate rolls in the six-high stand have a CVC contour for compensating  $x_n$ -defects.

In the six-high stand, the back-up roll has the CVC contour for compensating  $x_2$ -defects, the intermediate rolls have the CVC contour for compensating the  $x_n$ -defects, and the work rolls have means for compensating the edge drop phenomenon.

Since the hydraulic unit has an annular cylinder connected to the roll stand and an annular piston with an integrated ring connected to the roll, wherein the annular piston is sealingly guided in the annular cylinder, the hydraulic unit adapts particularly well to the shape of the hydrodynamic oil film



bearing. The diameter of the hydraulic unit is only insignificantly greater than the diameter of the bearing shell of the hydrodynamic oil film bearing.

A displacement of the rolls in both directions is possible because of the capability of applying pressure to both sides of the ring of the annular piston. The hydraulic oil for both directions of movement is alternatively supplied to the annular piston through the two hydraulic connections of the annular cylinder.

The position indicator serves for measuring the respective axial position of the axially displaceable rolls. This position is controlled by means of the hydraulic unit through the control circuit of the roll stand by utilizing the signals of the position indicator.

A particular advantage of the invention resides also in that the hydrodynamic oil film bearing with the hydraulic unit can be used as a retrofitting part. As a result, when retrofitting old plants, the existing chocks can be used. It is merely necessary to exchange the hydrodynamic oil film bearings. The pushing mechanism at the roll stand housing which requires space is unnecessary.

Further features of the invention result from the following

description and the drawing in which an embodiment of the invention is illustrated schematically.

The single Figure shows a longitudinal section of a hydrodynamic oil film bearing with hydraulic unit in the end position on the right hand side. Shown in the Figure is a roll stand housing 1 (or a chock) in which a bearing bushing 2 of a hydrodynamic oil film bearing 3 is arranged. The corresponding roll neck bushing 4 is seated with clamping cone on the roll neck 5 of a roll 6.

Attached to the roll stand housing 1 is an annular cylinder 7 in which an annular piston 8 is sealingly guided. This annular piston 8 is connected through conical roller bearings 9 to the roll neck 5. The annular piston 8 has on its circumference a ring 10 which is axially displaceable with the annular piston 8 in a groove 11 of the annular cylinder 7.

The groove 11 forms together with the annular piston 8 an annular space 12 which is divided by the ring 10. The portions of the annular space 12 are in connection with a control hydraulic system of the roll stand through separate hydraulic connections 13.

The free end of the roll neck 5 is covered in an oil-tight

manner by a cover 14. Attached to the cover 14 is a position indicator 15 which is connected through a connecting rod 16 to the free end of the roll neck 5. Annular cylinder, annular piston 8 and position indicator 15 form a hydraulic unit 17.

The arrangement according to the invention operates as follows: when an axial displacement of the roll 6 is required, hydraulic oil is applied to the right or left hydraulic connection depending on the desired direction of adjustment. This hydraulic oil acts, inter alia, on the annular surface of the ring 10 and thereby applies an axial force which is transmitted through the conical roller bearings 9 to the roll neck 5 of the roll 6. The axial displacement of the roll neck 5 is transmitted through the connecting rod 16 to the position indicator 15 which, in turn, controls the flow of hydraulic oil for achieving the desired roll position.

The arrangement according to the invention provides a simple, safe and space-saving axial displacement device which requires no maintenance because it is fully encapsulated. Because of these properties, the arrangement is also suitable for subsequent mounting in chocks of existing roll stands.

### Claims

1. Roll stand for hot-rolling or cold-rolling rolled strips of different materials, including work rolls, back-up rolls and, optionally, intermediate rolls arranged in pairs, wherein the rolls (6) of at least one pair of rolls are axially displaceable toward both sides and have a contour suitable for compensating rolling defects, characterized in that each displaceable roll (6) has at least one hydrodynamic oil film bearing (3) into which is integrated a hydraulic unit (17) which effects the axial displacement.

2. Roll stand according to claim 1, characterized in that the hydraulic unit (17) has an annular cylinder (7) connected to the roll stand, wherein an annular piston (8) with an integrated ring (10) connected to the roll is sealingly guided in the annular cylinder (7).

3. Roll stand according to claim 2, characterized in that pressure can be applied to both sides of the ring (10) of the annular piston (8).

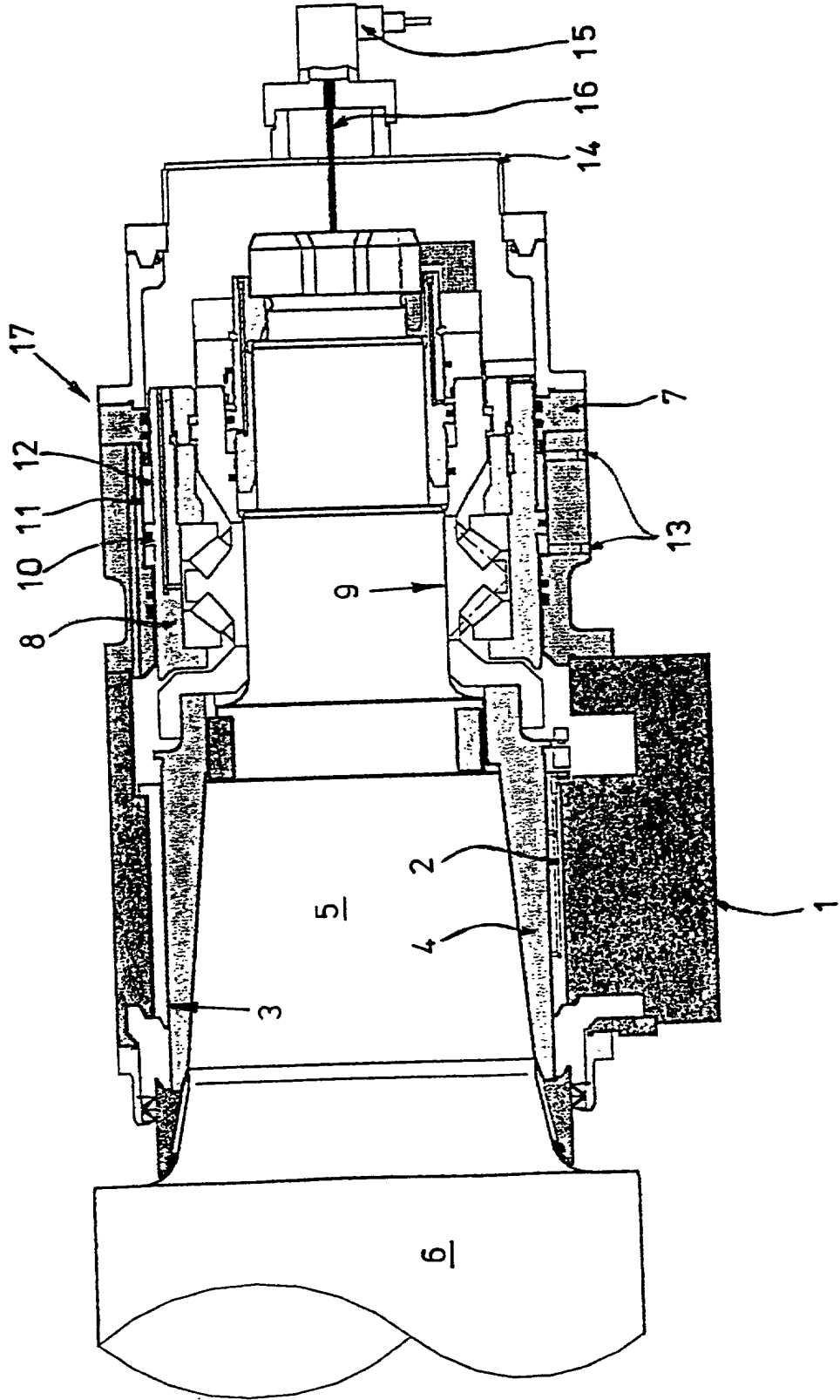
4. Roll stand according to claims 2 or 3, characterized in that the annular cylinder (7) has two hydraulic connections (13).

5. Roll stand according to one or more of claims 1 to 4, characterized in that a position indicator (15) is provided for each displaceable roll (6).

6. Roll stand according to claim 5, characterized in that the axial position of the displaceable rolls (6) is controllable by means of the hydraulic unit (17) through a control circuit of the roll stand by using the signals of the position indicator (15).

7. Roll stand according to one or more of claims 1 to 6, characterized in that the hydrodynamic oil film bearing (3) with the hydraulic unit (17) can be used as a retrofitting part.

8. Roll stand according to one or more of claims 1 to 7, characterized in that the hydrodynamic oil film bearing (3) with the hydraulic unit (17) can be mounted in front stands and/or rear stands of hot rolling mills and/or cold rolling mills.



As a below named inventor, I hereby declare that:  
My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: ROLL STAND WITH AXIALLY DISPLACEABLE ROLLS

the specification of which (check only one item below):

☐

is attached hereto.

☐

was filed as United States application

Serial No. \_\_\_\_\_  
on \_\_\_\_\_,  
and was amended  
on \_\_\_\_\_ (if applicable).

☒

was filed as PCT international application

Number PCT/EP99/02465  
on APRIL 13, 1999,  
and was amended under PCT Article 19  
on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT, indicate PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
GERMANY	198 16 602.8	15. APRIL 1998	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

**Combined Declaration For Parent Application and Power of Attorney (Continued)**  
(includes Reference to PCT International Applications)

Docket No.  
**HM-361**

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of the application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty of disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

**PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:**

U.S. APPLICATIONS		STATUS (CHECK ONE)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NO.		

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

**FRIEDRICH KUEFFNER, REG. NO. 29,482**

Send Correspondence to:

**FRIEDRICH KUEFFNER**  
**342 MADISON AVENUE, SUITE 1921**  
**NEW YORK, N.Y. 10173**

Direct Telephone Calls to:

**FRIEDRICH KUEFFNER**  
**(212) 986-3114**

100 2 0 1	FULL NAME OF INVENTOR	<u>Family Name</u> <u>Knepe</u>	<u>First Given Name</u> <u>Günter</u>	<u>Second Given Name</u>
	RESIDENCE & CITIZENSHIP	<u>City</u> <u>Hilchenbach</u> <u>DEV</u>	<u>State Or Foreign Country</u> <u>Germany</u>	<u>Citizenship</u> <u>German</u>
	POST OFFICE ADDRESS	<u>Post Office Address</u> <u>Theodor-Heuss-Straße 11</u>	<u>City</u> <u>57271 Hilchenbach</u>	<u>State &amp; Zip Code</u> <u>Germany</u>



Combined Declaration For Parent Application and Power of Attorney (Continued)  
(includes Reference to PCT International Applications)

Docket No.  
HM-361

2	FULL NAME OF INVENTOR	<u>Family Name</u> <u>Miller</u>	<u>First Given Name</u> <u>Heinz-Adolf</u>	<u>Second Given Name</u>
0	RESIDENCE & CITIZENSHIP	<u>City</u> <u>Wilnsdorf</u> DEV	<u>State Or Foreign Country</u> <u>Germany</u>	<u>Citizenship</u> <u>German</u>
2	POST OFFICE ADDRESS	<u>Post Office Address</u> <u>Höhstraße 18</u>	<u>City</u> <u>57234 Wilnsdorf</u>	<u>State &amp; Zip Code</u> <u>Germany</u>

2	FULL NAME OF INVENTOR	<u>Family Name</u> <u>Roeing</u>	<u>First Given Name</u> <u>Konrad</u>	<u>Second Given Name</u>
0	RESIDENCE & CITIZENSHIP	<u>City</u> <u>Hilchenbach</u> DEV	<u>State Or Foreign Country</u> <u>Germany</u>	<u>Citizenship</u> <u>German</u>
3	POST OFFICE ADDRESS	<u>Post Office Address</u> <u>Auf der Heide 1</u>	<u>City</u> <u>57271 Hilchenbach</u>	<u>State &amp; Zip Code</u> <u>Germany</u>

2	FULL NAME OF INVENTOR	<u>Family Name</u> <u>Müller</u>	<u>First Given Name</u> <u>Karl-Friedrich</u>	<u>Second Given Name</u>
0	RESIDENCE & CITIZENSHIP	<u>City</u> <u>Erndtebrück</u> DEV	<u>State Or Foreign Country</u> <u>Germany</u>	<u>Citizenship</u> <u>German</u>
4	POST OFFICE ADDRESS	<u>Post Office Address</u> <u>Im Streitplatz 3</u>	<u>City</u> <u>57338 Erndtebrück</u>	<u>State &amp; Zip Code</u> <u>Germany</u>

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Combined Declaration For Parent Application and Power of Attorney (Continued)  
(includes Reference to PCT International Applications)

Docket No.  
HM-361

SIGNATURE OF INVENTOR 201 <i>Guilherme</i>	SIGNATURE OF INVENTOR 202 <i>A. Miller</i>	SIGNATURE OF INVENTOR 203 <i>J. D. Miller</i>
DATE Hilchenbach, December 4th. 2000	DATE Hilchenbach December 4th. 2000	DATE Hilchenbach December 6th 2000
SIGNATURE OF INVENTOR 204 <i>Hans-Friedrich Miller</i>	SIGNATURE OF INVENTOR 205	SIGNATURE OF INVENTOR 206
DATE Hilchenbach December 6th 2000	DATE	DATE

Pt 1391 (REV. 10-83)

U.S. DEPARTMENT OF COMMERCE - Patent and Trademark Office